West Nile Story
Brenda Fowler, Chicago Tribune
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What do you get when a mosquito control district fails to control mosquitoes? Sick.

Last July 23, a crow plummeted out of the sky and landed in a yard near the intersection of South 55th Avenue and West 91st Street in Oak Lawn. The homeowner phoned the village hall and, since it was Oak Lawn's first such call, sanitation inspector Jeanne Foody Galzin came to collect it that same day. Galzin double-wrapped the crow in plastic, as she had been instructed, and sent it off to be tested.

When the results came back a week later, they confirmed fears that the crow was positive for West Nile virus, the mushrooming scourge that is potentially fatal to both humans and birds and can be transmitted through the bite of a single mosquito.

By that time, the July skies had begun to rain crows across Cook County. In Oak Lawn they fell from the magnificent elms that tower over lawns behind brick bungalows and tidy ranch houses, and littered the roads and roofs and cemeteries that rim the southern border of this mature suburb of 55,000. No one asked Oak Lawn to keep track of how many birds were reported dead, nor did they.

"It was a lot," says Galzin tersely.

Illinois public health officials already knew something frightening was brewing. They had been on the lookout for West Nile virus, an import from the Middle East, ever since it showed up in New York City in the late summer of 1999. The virus had spread at an alarming pace. By the end of 2000, presumably moved along by birds, West Nile had reached into North Carolina in the south and Vermont and New Hampshire in the north.

A year later, it entered Canada and spilled into the Midwest. During the fall of 2001, more than 100 birds died across the northeastern corner of Illinois. Infected mosquitoes were detected as well, but no human cases.

The earlier in the year birds begin to die, the more likely it is that the infection will have time to infiltrate the human population, says Linn Haramis, an entomologist who is manager of the vector control program at the Illinois Department of Public Health in Springfield. "Last year," he says, "we had our first dead bird on May 2, and I thought, 'Uh-oh.' "

By Sept. 10, Haramis' vector control department (vectors are the carriers that transmit disease) was reporting 292 human cases, more than any other state had seen in one year. Several states had similar attack rates--the number of people who got the disease per 100,000 population--but for sheer numbers, no state matched the toll in Illinois: In all of last year, 877 people were diagnosed with West Nile virus and 63 died.

Most people who become infected never know it because they do not get sick. Others display flu-like symptoms, a mild form of the illness that doctors call West Nile fever. But another group develops one of the two major complications: encephalitis or meningitis, inflammation of the brain or brain membranes, respectively. The group with these conditions is relatively small. According to the U.S. Centers for Disease Control and Prevention, only about 1 in 150 people infected with the virus will develop a severe form of the disease.

But the effects can be long-lasting. Seven months after the last person was infected last fall, some of those with complications still have not fully regained their health, says Mark Dworkin, the state epidemiologist at the Illinois Department of Public Health. There is no treatment for the virus and, so far, no vaccine.

Last year, 634, or 72 percent of the state's West Nile cases occurred in Cook County--not surprising, given the density of the population. But curiously, the cases clustered in two areas within the county.

One, toward the northern end of Cook, was centered in Skokie and Evanston, which together reported more than 80 cases and two deaths. The other was on the opposite side of the county, in the southwest suburbs of Oak Lawn and Evergreen Park. There, in an area no bigger than 12 square miles--just 1.2 percent of the area of the entire county--52 people were infected by the virus and three of them died. The number represents more than six times the rate of infection for the rest of Cook County.

Together, the two clusters accounted for 21 percent of the county's cases and nearly 8 percent of all West Nile deaths in Illinois.

Why so many people in these apparently ordinary suburbs got sick has much to do with the inscrutably complex interaction of the birds that harbor the virus, the mosquitoes that transmit it, the humans and other creatures who are bitten by them, and the ever-changing environment in which they live--the waters, green spaces and climate.

But the answer may also lie in how well local mosquito-control agencies did their jobs.

The first person to offer an explanation for the Oak Lawn-Evergreen Park cluster was Dr. Khian Liem, general manager of the South Cook County Mosquito Abatement District (MAD), whose territory covers 340 square miles of southern Cook, south of 87th Street between Indiana on the east and DuPage County on the west. It includes Oak Lawn and Evergreen Park.

A quietly confident man, Liem, 61, has been with the South Cook MAD since 1974 and became its manager in 1976, a year after another mosquito-borne viral disease, St. Louis encephalitis, infected more than 578 people in Illinois, killing 47. Oak Lawn and Evergreen Park were a focus of that outbreak too.

Liem hypothesized at that time that the many cemeteries rimming the two suburbs provided the perfect meeting ground for birds that carry the virus and the mosquitoes that transmit it. In interviews with local media last summer, Liem again pegged the cemeteries as the problem.

"They're very wooded areas where mosquitoes have their nests," Liem told the Daily Southtown last September. "A lot of people come to visit their loved ones. And when you live near these areas, you're practically surrounded."

But even as Liem was blaming the cemeteries, his own surveillance and abatement efforts were coming under scrutiny by the West Nile Virus task force, a multi-agency group chaired by the Cook County Department of Public Health that began meeting regularly last summer as the outbreak developed.

Some officials now say that Liem failed not only to adequately monitor the populations of mosquitoes in his district, but also to control their breeding and rid his district of adult mosquitoes, many of which were infected with West Nile virus.

"I think strong and accountable mosquito control is important, and I don't think we had that," says Dr. William Paul, the deputy commissioner of health for the Chicago Department of Public Health. Paul and other public health officials say they still have not received detailed information from Liem about his abatement efforts last summer.

But interviews with employees of the South Cook MAD and records obtained from Liem reveal that in most parts of his district, including Oak Park and Evergreen Park, employees did not begin applying pesticide to catch basins where mosquitoes breed--a process called "larviciding," which is considered the most fundamental element of a mosquito-control program--until two months after other abatement districts had done the job, and well after his lab had detected high numbers of infected mosquitoes. On some streets, records show, larviciding--which usually involves dropping larva-killing oil or briquets into catch basins--was done only after residents lay deathly ill in the hospitals.

The four mosquito abatement districts serving Cook County--South Cook County, Des Plaines Valley, Northwest and North Shore--are independent agencies supported primarily by local property taxes. Charged with the surveillance and control of mosquitoes, each district is licensed to apply pesticides by the state Department of Agriculture and required to report annually on its operations to the Illinois Department of Public Health.

One of their primary jobs is surveillance--identifying breeding sites and then trapping, counting and identifying adult mosquitoes to determine how dense they are at any given time and place. When a dangerous virus like West Nile lurks, good surveillance is crucial.

Before the emergence of West Nile virus, the abatement districts focused their treatments on the hard-biting floodwater mosquito, Aedes vexans, which emerges after rainfalls to pester people during their summer barbecues. But researchers think that it is the northern house mosquito, Culex pipiens, that is primarily responsible for transmitting West Nile virus from birds to humans, because human cases start to appear soon after large numbers of infected Culex are identifed.

In August 2001, even before the first dead crow was discovered in Illinois, West Nile was detected in Culex pipiens in Illinois by Don Oemick, an entomologist with the Northwest MAD. Researchers at the Illinois Natural History Survey's Medical Entomology Program in Champaign have since detected West Nile virus in 11 other species of mosquitoes in the state.

In northern climes, like Illinois', the viral transmission cycle is interrupted in the winter when mosquitoes either die off or go into hibernation. Then, in early April, the female Culex restuans, which is related to Culex pipiens, emerges from its winter hiding places, such as storm tunnels, and flies off to find a blood meal. From this blood the females get the proteins necessary to develop their eggs.

Culex mosquitoes prefer to feed on birds, many of which migrate during the winter, but pipiens, especially, will also bite mammals, including humans. Precisely how the cycle works is not yet clear.

According to Richard Lampman, a research entomologist at the Medical Entomology Program laboratory, the fact that some mosquitoes can harbor the virus through the winter and start infecting birds as soon as they emerge probably accounts for the ever-earlier appearance of the virus. At the same time, uninfected mosquitoes, which rarely make it more than a mile or two from their birthplace, pick up the virus when they bite viremic birds--those with the virus in their blood. Viremia starts a day or two after a bird is bitten and usually lasts three to seven days. Among the virus' avian hosts are crows and jays, which often die from the infection, and cardinals, house sparrows and robins, which usually do not. Once a female mosquito bites a viremic bird and picks up the virus, it can work its way to her salivary glands and then be injected into everything she bites after that. Typically, a female takes several blood meals in her lifetime.

As the weather grows warmer, the number of Culex restuans begins to decline and Culex pipiens emerges. Birds infected by Culex restuans are bitten again by Culex pipiens, which may then go on to bite humans or other mammals, such as horses, dogs or squirrels. The virus does not build up enough in mammals to be passed back to mosquitoes, though it can be passed to other humans via blood transfusion and even breastfeeding.

The first infected Culex Oemick captured came from a gravid trap he set up near the Des Plaines River in Northbrook. The gravid trap, basically a bucket of rotten-smelling grass and water overhung by a net, takes advantage of the fact that Culex females like to lay their eggs in water rich in organic matter, such as stagnant ponds or basins,. Attracted to the scent, the females approach the trap and are sucked into the net by a weak vacuum.

Last May, Oemick set out 13 gravid traps around his 241-square-mile district, as well as 13 light traps, which capture mosquitoes by attracting them to a light source. Nearly every day, Oemick and his staff collected the mosquitoes, sorted them according to species, and tested them. Then he sent them by overnight mail to Lampman at the Medical Entomology Program lab for more sensitive testing.

While Oemick ran surveillance and testing, more than 50 summer employees, mainly college students, fanned out through the district, which covers the northwest corner of Cook County, applying larvicide to stagnant water sites for Culex eggs, and to areas prone to flooding after rains, where Aedes vexans lay their eggs.

Among the most important stagnant-water sites on the list were the district's 132,000 catch basins, the large, bucket-like containers that lie beneath most sewer grates. When water runs through the grate into the sewer, it drops several feet into the catch basin, bringing along dirt, branches and clumps of leaves and grass that settle to the bottom. After water reaches the top of the catch basin, it flows into the sewer pipe, which opens two or three feet above the bottom of the basin.

Because catch basins retain stagnant, dirty water, they are notorious breeding sites for Culex, especially in dry periods when fresh rains haven't flushed out the larvae. Though the work is labor intensive, the Northwest Abatement District, which last year had a budget of about $1.8 million, tries to treat the catch basins at least once a month with methoprene, a larvicide. It comes in briquet form and can be dropped through the sewer grates into the catch basin, where it dissolves slowly over a month.

"Larval control is the primary and most effective method of controlling mosquitoes, and catch basins are an important aspect of that," says Robert Holub, manager of the 78-square-mile Des Plaines Valley MAD in Lyons, which last year had a budget of $1.1 million and ran operations similar to those in the Northwest MAD. "If you only have X amount of money to spend, larval control is the way to do it."

As temperatures warmed late last spring, the South Cook County MAD, which is the state's largest but which had a relatively small budget last year of about $1.7 million, began its surveillance and larviciding operations. In Oak Lawn, crews focused mainly on ditches along the Metra tracks, parks and waterways, and the cemeteries and the streets around them.

Mike Slamecka, a biologist who runs South Cook's lab, had half the number of traps of the Northwest district--eight light traps and five gravid traps--and they were spread out over a much larger area. The closest to Oak Lawn was a gravid trap hidden along a fence in Mount Greenwood Cemetery in Evergreen Park. Slamecka sent all the mosquitoes collected to the Medical Entomology Program lab in Champaign for testing.

Around July 20, roughly the same time that the first infected crow was falling into the yard in Oak Lawn, Slamecka learned that a "pool" of mosquitoes that he had sent from the Mount Greenwood trap was positive. That meant that at least one specimen in the pool, which usually contains 50 mosquitoes, carried the virus. It was the first time West Nile virus-infected mosquitoes had been detected in the area. Five days later, he had four positive pools, including two from Mount Greenwood. Slamecka did not keep track of how many pools he was sending in, but he did realize that almost every pool from Mount Greenwood was showing up positive.

"We weren't surprised that there were positives," says Slamecka. "It was the magnitude of it."

The last positive from Mount Greenwood was on Aug. 2. At that point, the trap was stolen, and, though it had been providing key information, it was not replaced. Meanwhile, at the Medical Entomology Program lab, where mosquitoes from around the state were being tested, Lampman was monitoring the sudden surge in the percentage of positive mosquito pools--from none in early July to 5 percent to 10 percent of all pools by the middle of the month--from the abatement districts in Cook County. Lampman and the lab director, Bob Novak, were concerned that the number of infected mosquitoes was already high enough to put humans at risk.

But neither man could have predicted what came next.

"Two weeks later, we pooled and plotted, and [the number of positive pools had risen to] over 75 percent," says Lampman.

In the Des Plaines Valley MAD, the percentage of positive pools rose to more than 90 percent. "This is something we had never seen before with [this kind of] virus," says Lampman. "If someone had told you that 90 percent of the pools would have been positive, you would have said it wasn't possible. It was brand new to all of us. And scary."

According to Dr. Roger Nasci, a research entomologist with the Centers for Disease Control and Prevention, the positive pool rate suggested that in some localities, at least 20 of every 1,000 mosquitoes were infected. But a new analysis by Wei Dong Gu, a biological modeler at the Medical Entomology lab, suggests that the infection rate might have been two to three times higher, or as many as 60 infected mosquitoes per thousand. By contrast, during the 1975 St. Louis encephalitis outbreak, only about 3 per 1,000 were infected.

West Nile's human incubation period--the time from the bite to the onset of symptoms--is between 3 and 14 days. Health officials didn't have to wait long to see the virus spill into the human population. On Aug. 6, the Illinois Department of Public Health reported its first case: a 22-year-old student from Maryland who had been living in Cook County and working with birds. The young woman had mild symptoms and recovered quickly. But just 10 days after that report, four new cases were announced, including that of a 70-year-old man from Oak Lawn who lived just two blocks from the spot where the village's first dead crow had fallen.

The man had first felt unwell on Aug. 3, says his wife, who does not want the family's name used. Three days later, he was hospitalized with a fever of 102.4 degrees.

Still unaware that the man had West Nile virus, doctors operated on him for an unrelated problem that they thought was causing the fever, his wife says. Immediately following the procedure, he seemed better, but when she came in the next day, he was on a respirator. His fever had risen to 105 and doctors, who had begun to suspect West Nile virus, ordered a spinal tap that revealed encephalitis. Not until almost a week later did they confirm West Nile.

By that time, says his wife, the man had suffered brain damage and was unresponsive. For most of the next five weeks, he stayed under intensive care and then was transferred to a nursing home, where he died three weeks later.

"I had to take him off the respirator myself," says his wife, who wonders if he was bitten by a mosquito in their back yard. "He was a great feeder of birds," she says. A family of about 25 crows frequented their back yard, and last summer they had found one dead.

On the morning of Aug. 12, another Oak Lawn resident, Bennie Casalina, took a few steps out of his bedroom and collapsed next to the dining-room table. Casalina, a bear of a man with a full head of gray hair, doesn't recall anything of the next three weeks, but for his wife, Yvonne O'Neill, it was a nightmare.

Emergency room doctors at Advocate Christ Medical Center in Oak Lawn initially thought Casalina had suffered a stroke, because his left side was paralyzed. But two weeks after his arrival at the hospital, a test revealed West Nile antibodies. After months of rehabilitation, Casalina says he feels amost back to normal.

Typically, West Nile victims have such symptoms as headache, fever and sometimes a rash. If they have progressed to encephalitis or meningitis, they will display confusion and lethargy. But of the 56 West Nile patients seen at Advocate last year, several came in with symptoms not previously associated with West Nile---mainly paralysis and other neurological consequences of brain inflammation, according to Dr. Stephen Sokalski, the hospital's director of epidemiology and head of its infectious disease section. Four of the 56 died.

"The sicker they came in, the likelier the fatal outcome," says Dr. Mel Wichter, a neurologist at the hospital who treated Casalina. "But the fatality rate is really, really small."

By the second half of August, epidemiologists had begun to notice the clusters of cases developing in Oak Lawn-Evergreen Park and in Skokie-Evanston. Barb O'Meara, an environmental health specialist with the Illinois Department of Public Health, was quickly dispatched to set up gravid and light traps at five sites in Oak Lawn. O'Meara and a colleague from the Cook County Department of Public Health then began visiting sites where humans had become infected, looking for mosquito breeding sites and other factors that might explain the cases.

At their first stop, a man led her to a catch basin set in the grass of his back yard to drain water that collected there during heavy rains. The man said his wife had noticed mosquitoes flying up through the grate. Three doors away, O'Meara found another back-yard catch basin.

"That's when I called the sewer department," says O'Meara, who would learn that, decades ago, Oak Lawn had installed between 1,000 to 2,000 catch basins in poorly drained backyards but had failed to keep a record of them because they weren't on city property.

The sewer workers lifted the grate off one of the basins, and O'Meara dipped a ladle-like tool into the stagnant pool. Inside the filthy water, mosquito larvae were clearly visible.

"They hatched out, which told me that that catch basin had not been larvicided," says O'Meara. Over the next few weeks, at site after site where people had come down with West Nile virus, O'Meara found undocumented back-yard catch basins with mosquitoes breeding inside, sometimes just feet away from where the homeowners had their picnic tables. The mosquitoes did not have to fly in from Oak Lawn's cemeteries; they were breeding in the very neighborhoods where infected crows were being found dead.

"Every site we visited we were able to establish that there were mosquitoes breeding on the site or within one to two houses," O'Meara says. "It wasn't always the catch basin. At one house there was a Dixie cup and the Dixie cup was breeding Culex. That's why the personal responsibility of cleaning and looking in your own yard is so important."

Meanwhile, the mosquitoes in O'Meara's traps were coming up positive for West Nile. "Every trap that I had set out in Oak Lawn, I got positive mosquitoes out of," says O'Meara. "Was the virus spread through the entire town? Yes, it was, and into Evergreen Park."

While suggestive, O'Meara's discovery did not entirely explain the cluster of cases in Oak Lawn. After all, there must have been breeding sites and infected crows around the homes of people elsewhere in Cook County who never got sick.

But public health officials were beginning to wonder precisely what mosquito-abatement treatments had been undertaken in Oak Lawn and Evergreen Park.

Tom Varchmin, the chair of the Cook County task force, says it had become clear during task-force meetings that the four mosquito-abatement districts had different philosophies about mosquito control.

At the Northwest MAD, where the first positive Culex mosquitoes turned up in mid-July and many dead birds were being found, Mike Szyska had stepped up his treatments even before the first human case. Beginning in July, Northwest MAD trucks took to the streets at sunset, when the Culex become active, spraying pesticide at ultra-low volume in the areas where positive mosquito pools had shown up.

"Once you have infected mosquitoes flying around in an area that could potentially infect more birds or possibly even humans, the only way to knock them down is by adult mosquito spraying in the evening," says Szyska.

Despite assurances that the pesticide was safe, many residents still were not happy to see the frequent spraying, and many called to complain. But as the human cases continued to mount, Varchmin and other officials at the West Nile task force were less concerned about Northwest MAD's repetitive spraying than they were about what the South Cook district was doing---or not doing.

Though Liem and Slamecka, his lab director, attended task force meetings, Liem's answers about his spraying and larviciding operations were vague.

"His statement was 'I do treat'--that was as specific as we could get out of him," says Varchmin.

Since Liem's district covers the southern tip of Chicago---where a surprising number of people had also become infected--city officials were also pressing him to report what pesticide he had used and where and how frequently he used it.

"We at the City Health Department tried to communicate with the South Cook MAD on treatment of catch basins in its portion of the city," Dr. William Paul told the Illinois House Human Services Committee last October during hearings related to public health and

potential bioterrorism. "We could not get a straight answer as to their plans and carry-through. The story kept changing, and there was no documentation of what they said they were doing."

In fact, only a small number of the thousands of catch basins in Oak Lawn and Evergreen Park had been regularly inspected before July and they were treated only when they were found to be breeding, according to maps and records provided by the South Cook MAD, and explained by its general foreman, Douglas Wright. Not until August did crews start to treat all catch basins in the streets. The unrecorded ones in homeowners' back yards were never done.

In the section of town that includes 101st Street, where Bennie Casalina lives, crews finally began putting larvicide in the street catch basins on Aug. 3, but "for some reason," Wright says, they were pulled off the job before it was completed and did not return until Aug. 30, by which time several people in Oak Lawn had fallen ill with West Nile.

In the neighborhood that includes both the intersection where Oak Lawn's first dead crow was discovered and the residence of the first man who died of West Nile, treatments were similarly spare. On Aug. 19, by which time nearly every catch basin in the Northwest and Des Plaines Valley MADs had been larvicided at least twice, South Cook finally sent its workers to drop larvicide into catch basins in that area for the first time.

Still unaware of exactly what South Cook was doing, but increasingly frustrated by Liem's vague responses, other authorities stepped in.

"We determined in August that we needed to start preventive efforts in the Chicago neighborhoods served by the South Cook MAD from scratch," the city Health Department's Paul testified last October.

In Evergreen Park, Mayor James Sexton tried to learn from South Cook precisely what had been treated in his village. "I mentioned that I had never seen their trucks or their people, but they assured me that [the catch basins] were being done," says Sexton. Unconvinced, he persuaded his board to buy 2,000 larvicide briquets at 90 cents each, which were then dropped into Evergreen Park catch basins by village firemen who volunteered for the job.

By the first week of September, the positive mosquito pools from Cook County had begun to drop off, but the number of people entering the hospital with West Nile was still high. Public health officials on the task force agreed that they should mobilize the only tool they had against infected adult mosquitoes. In areas that showed clusters of human cases, all streets and alleyways were to be sprayed twice within the space of a few days.

The Northwest, Des Plaines Valley and North Shore MADs did their own spraying. But in southern Cook, county officials hired Clarke Mosquito Control, a commercial firm, to spray Oak Lawn, Evergreen Park and several other areas of Chicago and suburban Cook. Part of the problem was that the South Cook abatement district professed to be cash-short and, with only one sprayer to its name, says it could not undertake the large-scale spraying the county envisioned.

In a letter sent shortly after the spraying operation to Dr. Karen Scott, then director of the Cook County Department of Public Health, Liem said his district could not even afford the $500,000 Clarke was charging for the spraying. And he seemed to want credit for his district's thrift.

"My Trustees should be highly commended and applauded for being unwilling to spend any monies that the district does not have and to go into debt by borrowing from the bank," he wrote.

Not that Liem hadn't tried previously to get more funds for mosquito control. In interviews during March and April of this year, Liem pulled out copies of letters he had written in July 2000 to Cook County Board President John H. Stroger Jr. and nearly two dozen senators and representatives in southern Cook, complaining that he needed more money to prepare for the possible arrival of West Nile virus.

He said his budget had never recovered from being slashed in 1991 after auditors uncovered a $1.5 million surplus that Liem defended as a contingency fund for operations and a new building. He said that while his budget had risen slightly since his complaints in 2000, he had not gotten the infusion of cash that he said was necessary to brace the district against West Nile.

"If I had the manpower, I would have done more surveillance work and larviciding," Liem says. "But my hands are tied when I have only 11 or 12 people covering 340 square miles."

But it is likely that, even if his office had the money, Liem would not have done the kind of spraying for adult flying mosquitoes that the county wanted. He doesn't think it works.

"We don't want people to scream at us when they see a truck going up and down the street," he says, noting that where he did spray--for example in the cemeteries--he did not use the synthetic pyrethroids favored by the Northwest MAD, but real pyrethrin, an extract from the chrysanthemum, because he believes it is safer for people.

But generally, he argues, while spraying for adult mosquitoes may be a "good show" and induce a placebo effect against West Nile in certain people, it was a waste because scientific studies have not demonstrated that it works.

"I was asked many times to compromise and I said, 'How do you compromise knowledge? How do I compromise science?' "

While entomologists agree that the efficiency of spraying to kill adult mosquitoes is debatable, they insist that it does kill those mosquitoes it hits, and thus was worth using, even if the efficiency was lower than desired.

"I am very concerned about Dr. Liem's comments marginalizing the use of mosquito adulticide applications as a component of an integrated West Nile response program," wrote Dr. Duane Gubler, then director of the CDC's Division of Vector-Borne Infectious Diseases, in a letter last October to the county health department.

So far, no data has been produced illustrating that infections in Cook County dropped off after the coordinated attack on adult mosquitoes. Yet a glance at the map of the human cases and the borders of the mosquito abatement districts suggests a link between the intensity of mosquito abatement efforts and human cases.

The two districts with the most mosquito surveillance and best documented larviciding and adulticiding operations, Northwest and Des Plaines Valley, had the fewest number of cases. Lampman, the entomologist, notes that the low number of cases in the Des Plaines Valley district is all the more striking because of the extremely high percentage there of positive mosquito pools--more than 90 percent at one point.

"It is my own personal feeling that if we had not brought Clarke Mosquito Control in [to South Cook] to provide additional services, there was a good chance that there would have been more cases of West Nile virus and possibly more deaths," says Varchmin.

At a heated meeting last fall of the Southwest Conference of Mayors, mayors accused Liem of neglecting his responsibilities in their communities, which were paying for his services through taxes.

Some complaints about the operations at the North Shore MAD, including the use of ineffective mosquito traps and failure to spray the alleys in Evanston, have also arisen since last summer. In Evanston, where many people have long been opposed to adulticiding because of concerns about pesticides, residents were permitted to request that their yards not be sprayed.

"If one street had five or six houses that did not want spray and only eight houses, then it would not be sprayed," says George Xamplas, an ecologist with the North Shore Mosquito Abatement District.

No one has yet examined whether there is a correlation between Evanston-Skokie's sometimes-spotty adulticiding and the human cases. But in his successful campaign last fall for Cook County commissioner from the 14th District, which covers Skokie and Evanston, Larry Suffredin drew attention to press reports that surfaced two years ago alleging improper hiring practices and abuse of expense accounts at the North Shore MAD.

"Let's just say that two of the MADs are not doing the job they should," says Suffredin. He has helped shape legislation now moving through the Illinois House and Senate that would consolidate the abatement districts into one covering most of Cook County, and require better reporting of surveillance results and treatments to local health departments.

While the relatively low number of cases in the Northwest and Des Plaines Valley MADs may be attributable to good mosquito abatement, entomologist Lampman says there must be other factors behind the human clusters because other municipalities in the South Cook County district that were not adequately larvicided or adulticided would have seen a concentration of West Nile cases.

One possibility that researchers are considering is the correlation between the number of crows in an area and the number of human cases. According to O'Meara, the Illinois Department of Public Health investigator, residents of both Oak Lawn and Evanston reported large populations of crows in their areas before the outbreak.

Last summer, Sarah Yaremych, a master's student in the Department of Natural Resources and Environmental Sciences at the University of Illinois in Urbana-Champaign, tracked 39 crows that were feeding and roosting in an area where she also found infected mosquitoes. Yaremych found that when the large birds became infected, they moved around less, possibly making them more

vulnerable to mosquitoes. The finding could explain why large numbers of mosquitoes can become infected in areas with lots of crows.

By last fall, at least 49 percent of Yaremych's crows had died. Her study confirms evidence from around the state that populations of birds, especially crows, jays and chickadees, have declined dramatically.

"Basically what we found is that in the areas where there were high numbers of human cases, the crows and chickadees were absolutely missing," says Judy Pollock, Chicago region projects manager for the National Audubon Society.

Even as scientists scramble to evaluate data collected from last summer, the new season of West Nile is upon us. In New York, the second and third years of West Nile activity were not as bad as the first, but last year, the fourth, the state had more human cases than ever, despite improved surveillance and abatement efforts.

"The status of the disease can change from year to year, so making a prediction is really risky. Really risky," says Lampman, who is investigating whether species besides Culex pipiens may be infecting humans.

Scientists agree that the virus is not going away, and that people have to learn to deal with it, mainly by eliminating breeding sites around their homes and protecting themselves with repellent.

Many people in Cook County did not feel that last summer, which was hot and dry, was a particularly bad summer for mosquitoes. That is probably because there were fewer pesky Aedes vexans, the floodwater mosquitoes that need rain for their developing eggs. But drought is good for the Culex, because its eggs, laid in stagnant water, aren't washed away.

"The throttle is heat," says Haramis, the IDPH entomologist. "Not only do mosquitoes breed more quickly when it's hot, but the virus replicates more quickly in the mosquito."

Mild winters also favor the survival of hibernating mosquitoes, so Haramis says that while things can change, it's a good early sign that the recent winter's cold temperatures were near average.

"I can make one prediction," says Nasci, of the CDC. "Chicago will have West Nile virus activity this year. How much? That's why the surveillance program is there. All of the programs should be advised to prepare for a possible repeat of last year."